US007434747B2

(12) **United States Patent**
Helzer et al.

(10) **Patent No.: US 7,434,747 B2**
(45) **Date of Patent: Oct. 14, 2008**

(54) **INTERNAL PARTICULATE PROTECTIVE OBSTRUCTION FOR SPRINKLERS**

(75) Inventors: **Bradley D. Helzer**, Ontario (CA); **Jonathan Yeh**, Chino, CA (US)

(73) Assignee: **Rain Bird Corporation**, Azusa, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 63 days.

(21) Appl. No.: **10/979,671**

(22) Filed: **Nov. 2, 2004**

(65) **Prior Publication Data**

US 2006/0091236 A1 May 4, 2006

(51) **Int. Cl.**
B05B 3/04 (2006.01)

(52) **U.S. Cl.** **239/240**; 239/205; 239/570; 239/571

(58) **Field of Classification Search** 239/237, 239/240, 241, 242, 263.3, 264, 576, 577, 239/571, 541, 456, 200–206, 570
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,570,447 A * 3/1971 Basseches et al. 116/112
3,733,030 A * 5/1973 Carstenson 239/205
4,026,471 A * 5/1977 Hunter 239/206
4,340,179 A * 7/1982 Knapp 239/310
4,681,260 A * 7/1987 Cochran 239/240
4,796,804 A * 1/1989 Weiss 239/1
5,009,368 A * 4/1991 Streck et al. 239/70
6,502,764 B2 1/2003 Walker

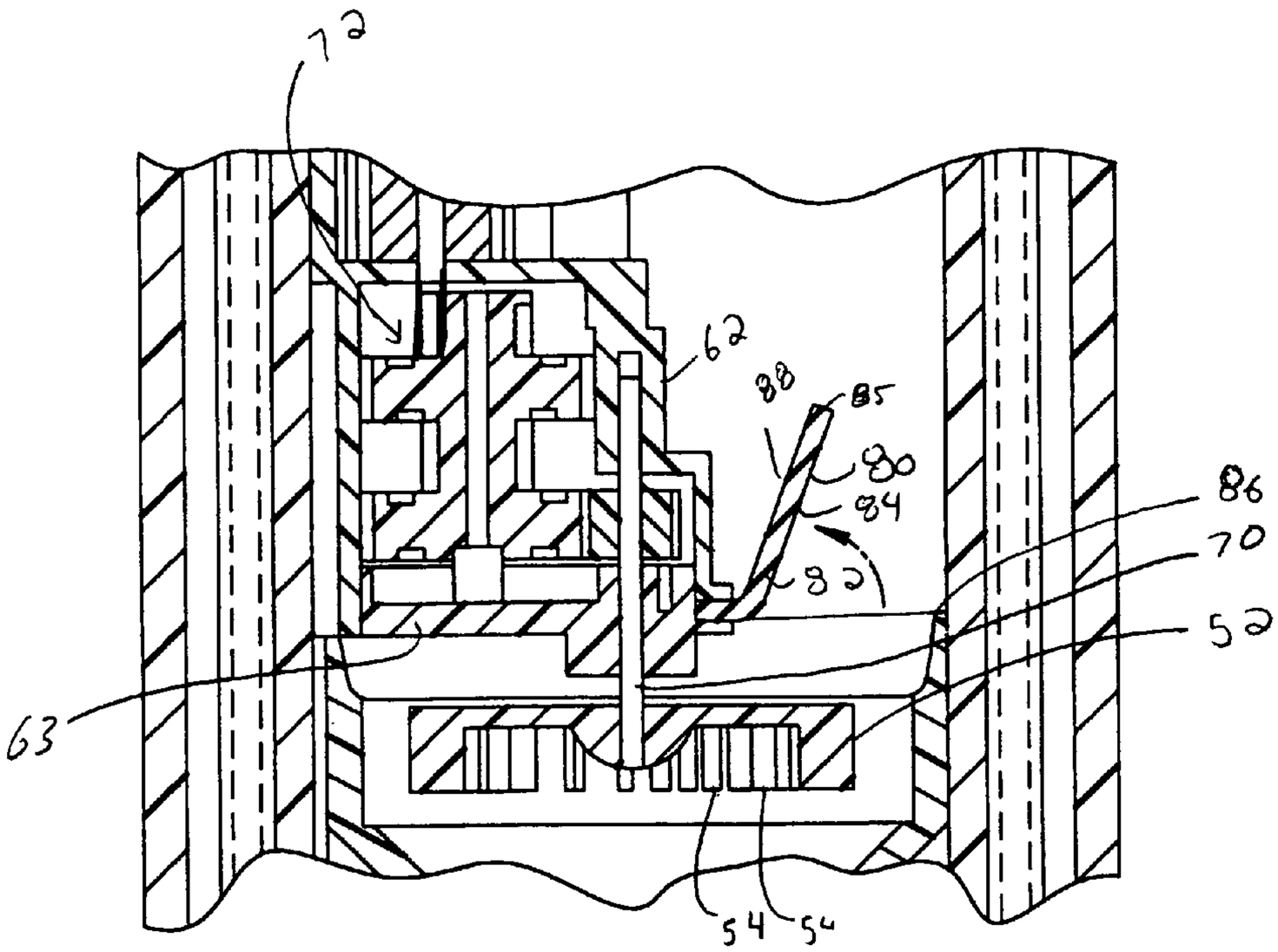
* cited by examiner

Primary Examiner—Christopher S Kim
(74) *Attorney, Agent, or Firm*—Fitch, Even, Tabin & Flannery

(57) **ABSTRACT**

A sprinkler that restricts foreign particulate matter from interfering with and/or damaging the operating components of a sprinkler is disclosed. The sprinkler may be a pop-up sprinkler such that the outlet or nozzle is not in a fixed position and is moved from a position above the ground to a position generally below or flush with the ground. To prevent particulate matter from entering, such as through the nozzle or outlet, when the flow of water is shut off, the sprinkler may include a protective member located within the sprinkler head to prevent the particulate matter from have an undesirable effect. The protective member forms a one-way obstruction that permits flow to the nozzle and obstructs flow back into the sprinkler such that particulate matter in the water beyond the protective member is restricted from coming in contact with the internal operating components of the sprinkler. The protective member may be a resiliently deformable flap or a hinged flap.

3 Claims, 4 Drawing Sheets



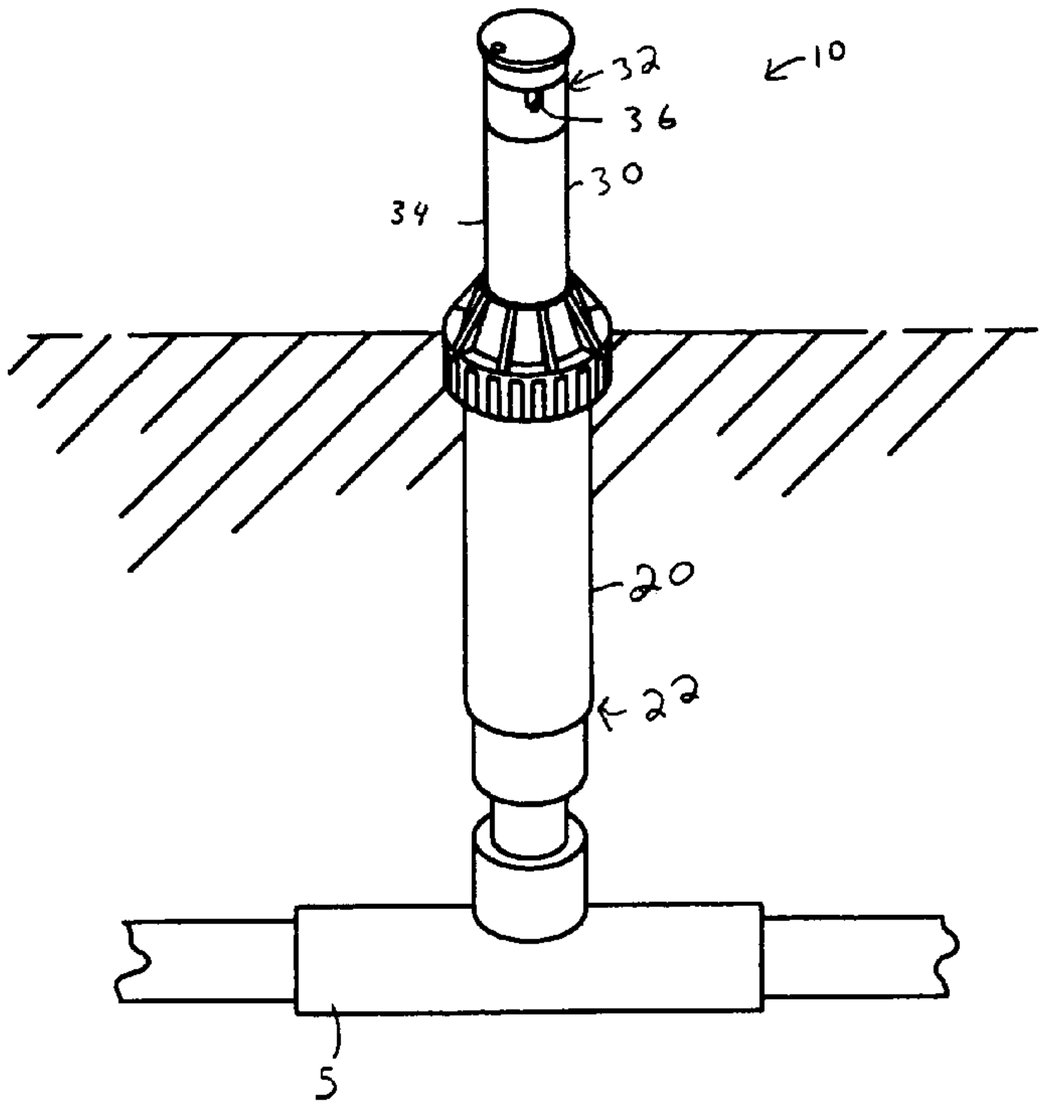

32
10
36
30
34
20
22
5

FIG. 1

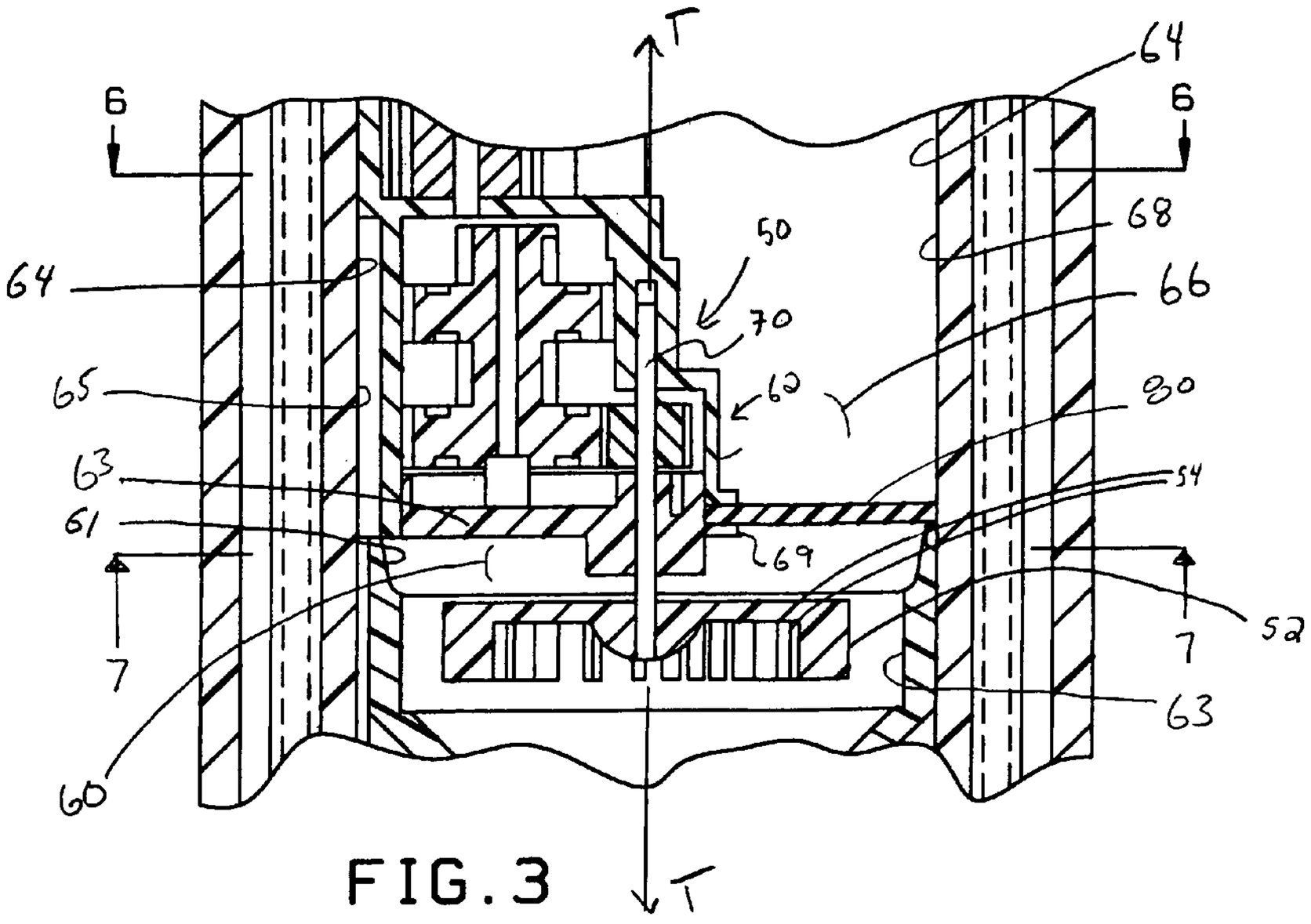

T
6
64
6
68
50
64
66
70
65
60
80
63
54
61
69
7
52
7
63
60
T

FIG. 3

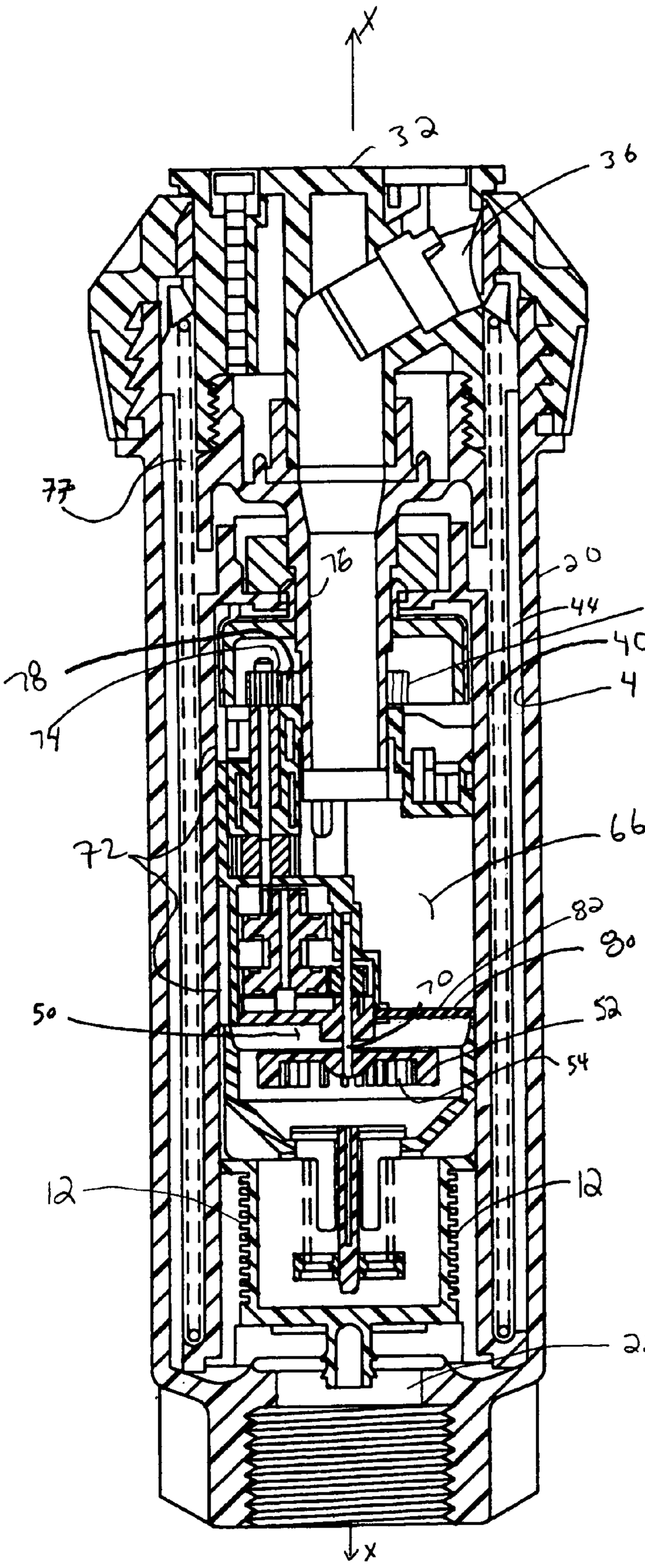


FIG.2

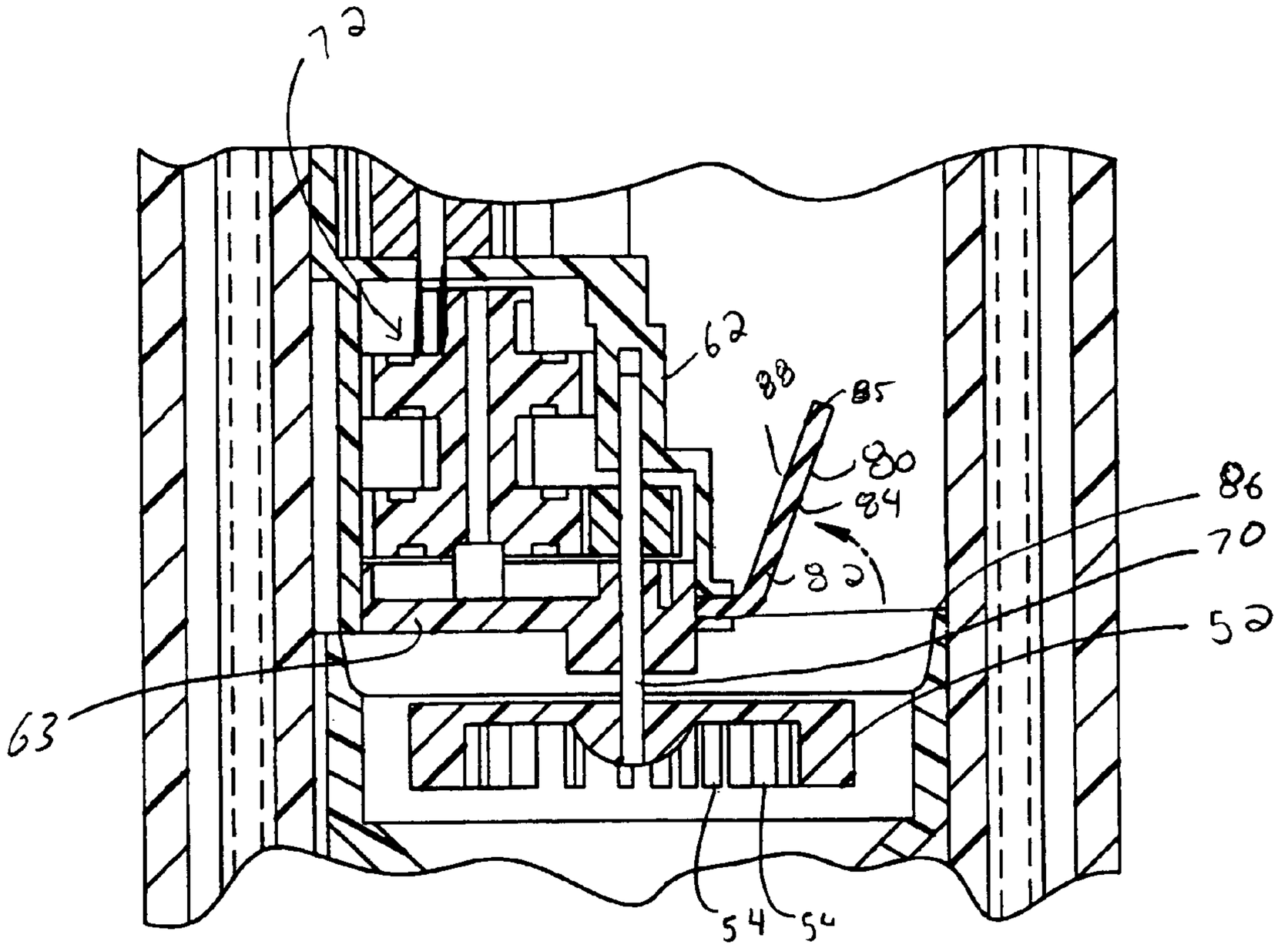


FIG. 4

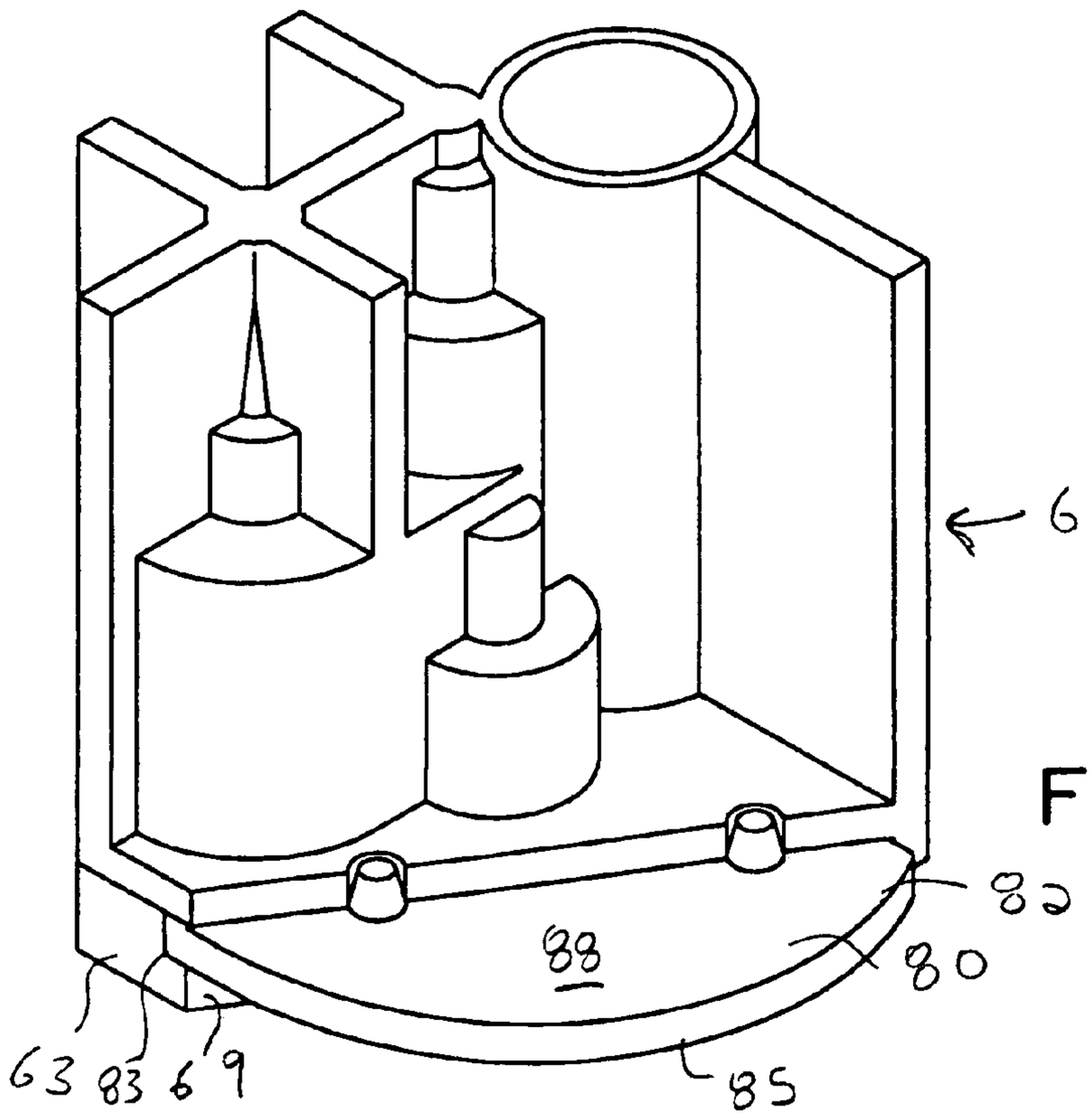


FIG. 5

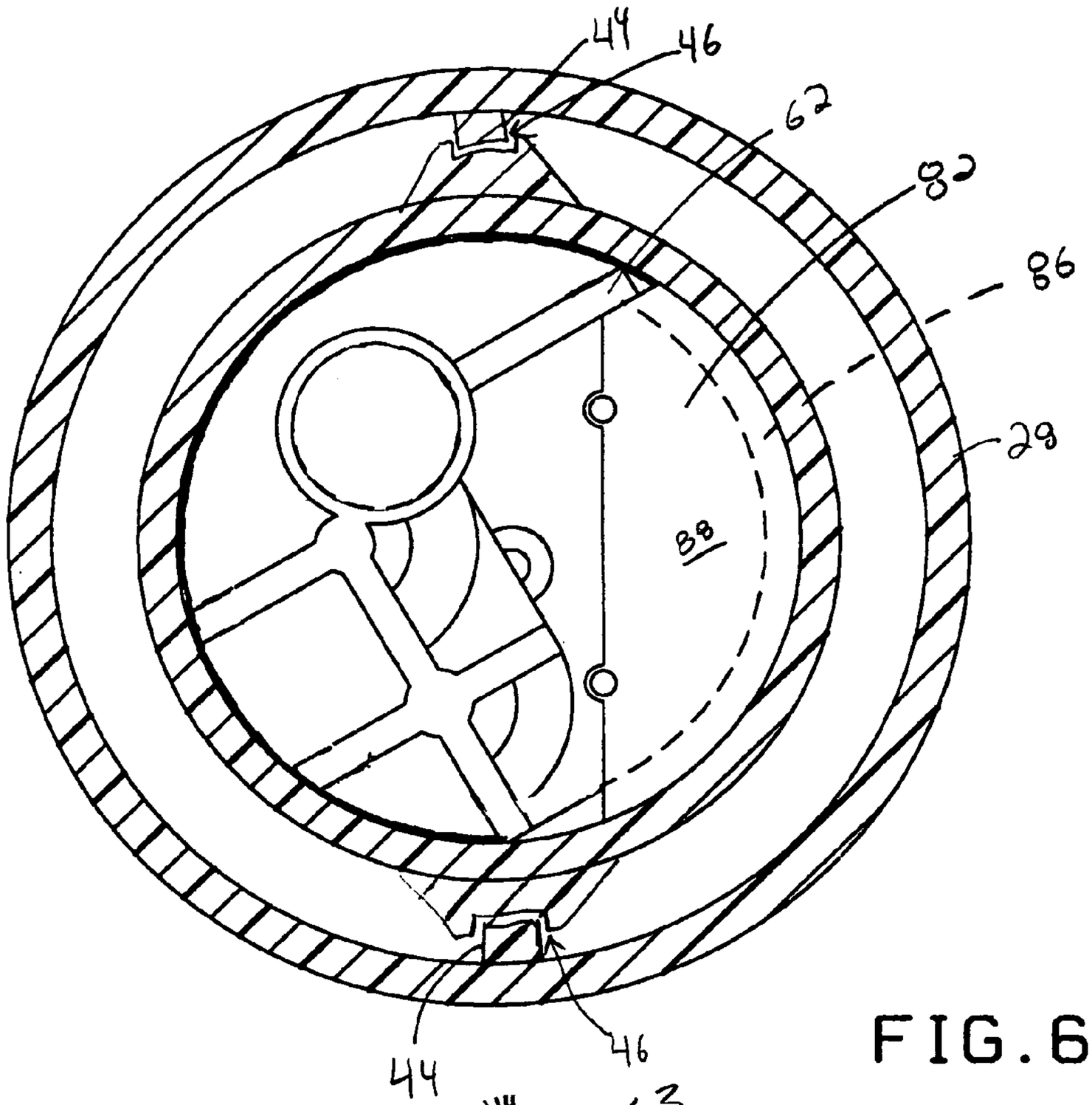


FIG.6

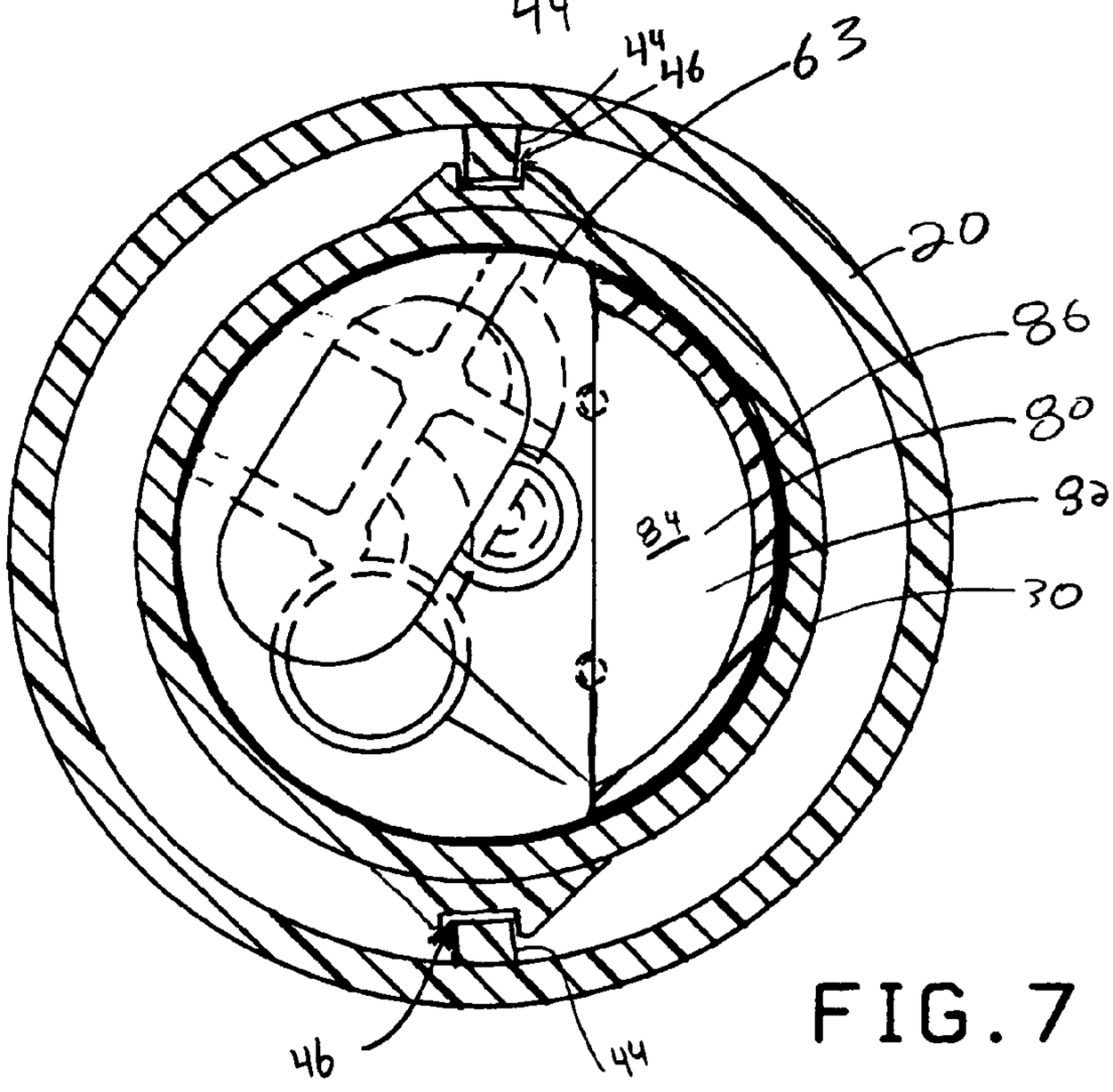


FIG.7

INTERNAL PARTICULATE PROTECTIVE OBSTRUCTION FOR SPRINKLERS

FIELD OF THE INVENTION

The invention relates to a sprinkler and, in particular, to an internal particulate protective obstruction to restrict the entry of foreign matter into a sprinkler.

BACKGROUND OF THE INVENTION

Sprinklers are widely used in both commercial and residential settings, for instance, to control the irrigation of crops or to maintain the healthy appearance of lawns. Most often, sprinklers are used in outdoor settings, such as in agricultural or other fields, on golf courses, and on residential lawns. As a result of being in an uncontrolled, outdoor environment, sprinklers are exposed to airborne particles, such as pollen, seeds, and bugs, as well as other loose debris, such as dirt and tree bark.

By design, sprinklers have openings to allow water from a pressurized source to be distributed to their surrounding areas. Therefore, it is possible for foreign contaminants to enter the sprinkler housing through the spray head nozzle outlet, especially when water is not flowing. Pop-up sprinklers, in particular, are prone to the entry of foreign contaminants into the sprinkler mechanism.

Pop-up sprinklers are especially susceptible to the entry of foreign contaminants due to the nature of their operation. In a pop-up sprinkler, the spray head nozzle outlet is mounted in a movable casing that travels between a position below the surface of the ground and a position above the ground. When the sprinkler is turned off, the spray head may be retracted below the surface of the ground so that the ground is generally flush with or close to the top of the spray head. When the sprinkler is in operation, the spray head moves to a position above the ground to distribute water to the surrounding areas. As a result of this motion, dirt and other particles around the sprinkler housing may become disturbed, making it more likely that these particles will gain entry into the sprinkler.

Once the foreign contaminants are inside the sprinkler, they may disrupt its operation. For example, many sprinklers have a rotary drive mechanism. Particles of dirt may prevent the rotary drive mechanism of a sprinkler from properly rotating the spray head, or may even damage the drive mechanism. Such a malfunction or damage caused by the entry of foreign contaminants would mostly likely require the sprinkler to be completely removed from the ground and either replaced or repaired, costing time and energy and potentially disrupting the entire irrigation scheme of the area being watered.

Accordingly, there is a need for a sprinkler with improved resistance to the entry of foreign contaminants or particulate matter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a rotary drive pop-up sprinkler in an extended use position;

FIG. **2** is a fragmentary cross-sectional view of the sprinkler of FIG. **1** in a retracted position showing a protective member in a substantially closed position;

FIG. **3** is a partial cross-sectional view of the sprinkler of FIG. **2**;

FIG. **4** is a fragmentary cross-sectional view of the sprinkler of FIG. **2** showing a protective member in a substantially open position;

FIG. **5** is a perspective view of a drive housing and the protective member of FIG. **3** in a substantially closed position;

FIG. **6** is a cross-sectional view of the sprinkler taken through line **6-6** of FIG. **3** with the protective member in a substantially closed position; and

FIG. **7** is a cross-sectional view of the sprinkler taken through line **7-7** of FIG. **3** with the protective member in a substantially closed position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a representative pop-up sprinkler **10** in an operative position for distributing water. The pop-up sprinkler **10** includes a tubular, fixed housing, or sprinkler case **20**, that is telescopically connected to a tubular, movable housing **30** such that the housing **30** may move from an operative position to an inoperative position. In the operative position, the housing **30** extends from the case **20** to position a spray head **32** is above the ground surface to distribute water to the surrounding area. In the inoperative position, the housing **30** retracts into the sprinkler case **20** such that the spray head **32** is generally flush with or beneath the surface of the ground.

The sprinkler case **20** has an inlet connection **22** for connecting to a pressurized water supply line **5** that delivers water to the sprinkler **10**. The sprinkler **10** may include a filter or screen **12** (FIG. **2**) located near the inlet connection **22** and in the path of the entering water to screen out foreign particulate matter from the water source. The water passes through the sprinkler **10** and is emitted from the spray head **32**.

The housing **30** includes a base portion **34**, and the spray head **32** is disposed at the distal end of the base portion **34**. The spray head **32** includes a nozzle outlet **36** from which water is projected out of the sprinkler **10**. When the sprinkler **10** is shut off so that substantially no water is emitted, the movable housing **30** retracts to the inoperative position. In the inoperative position, the nozzle outlet **36** is retracted into the sprinkler case **20** to close off the sprinkler **10**. However, in some instances, loose debris, bugs, or proximal plants may enter the nozzle outlet **36**, such as when it moves between the inoperative and operative positions, and, as a result, the nozzle outlet **36** does not retract completely to close the interior of the sprinkler **10**, which may allow a seepage of groundwater and contaminants.

Prior to the sprinkler **10** being activated to distribute water to the surrounding area, the sprinkler **10** is in the retracted inoperative position, as is shown in FIG. **2**, wherein the housing **30** and its internal components are located within the sprinkler case **20**. Once the water is turned on and the sprinkler **10** is activated for distributing water, the water pressure from the inlet **22** forces the movable housing **30** upwards so that it extends from the sprinkler case **20**, and water can emit from the nozzle outlet **36**. The movable housing **30** has an exterior surface **40** generally directed towards an interior surface **42** of the sprinkler case **20**. The surfaces **40**, **42** generally include cooperating structure that permits the movable housing **30** to move generally along the central longitudinal axis X of the sprinkler case **20**, while generally preventing relative rotation between the sprinkler case **20** and the movable housing **30**. Preferably, the cooperating structure includes a plurality of ribs **44** radially located on the interior surface **42** of the sprinkler case **20**, and recesses (not shown) equal or greater than the number of ribs **44** and located on the exterior surface **40** of the movable housing **30**. The cooperating structures, such as the ribs **44** and recesses, guide the relative longitudinal movement between the housing **30** and

the sprinkler case **20**. The recesses may be formed on a lower portion, such as a ratchet (not shown), of the movable housing **30**.

As the water passes through the movable housing **30**, it drives a rotary drive mechanism **50** disposed within the movable housing **30**. The drive mechanism **50** utilizes the force of the water to rotate the spray head **32** relative to the movable housing **30** and the sprinkler case **20** so that water projected from the spray head **32** is distributed over a predetermined arcuate range, such as a full or partial circular area.

Water entering the rotary drive mechanism **50** located at a lowermost portion of the movable housing **30** generally strikes a turbine **52**, including turbine blades **54**, as illustrated in FIG. **3**. The turbine **52** has a generally disc-like configuration with openings (not shown) to permit water to pass through the turbine **52**. The blades **54** are located radially about a central axis T of the turbine **52** and adjacent the openings in the turbine **52** so that a portion of the kinetic energy of the water is imparted to the blades **54** when the water strikes there against as the water passes through the turbine **52**.

A main water channel **66** is located within the movable housing **30** and above the turbine **52**. A lower cavity **60** defined in part by a bottom plate **63** of a drive housing **62** and by a turbine draft surface **61** of the movable housing **30** is located in part below the drive housing **67** and in part below the channel **66**. The channel **66** is generally located between a portion **68** of an interior surface **64** of the movable housing **30** and the drive housing **62**. The drive housing **62** abuts another portion **65** of the interior surface **64** of the movable housing **30** and includes the bottom plate **63**. Once the water passes through the turbine **52**, it flows either directly through the lower cavity and into the channel **66** or into the portion of the lower cavity **60** under the bottom plate **63** of the drive housing **62**. The bottom plate **63** forces the water to a channel side **69** of the lower cavity **60** for passage into the channel **66**. The water generally follows the channel **66** to the nozzle outlet **36** for distribution or emission from the sprinkler **10**.

With reference to FIG. **2**, the turbine **52** is fixed at its central axis T to a drive shaft axle **70** such that rotation of the turbine **52** causes rotation of the drive shaft **70**. The water force on the turbine blades **54** is transmitted through the turbine **52** and to the drive shaft **70**. The drive shaft **70**, in turn, extends through the bottom plate **63** of the drive housing **62** and is in geared cooperation with a drive mechanism **72** which is, in turn, connected to the spray head **32** by an output gear **74**. The drive mechanism **72** includes a series of gears ratioed to reduce the input rotational velocity of the turbine **52** and drive shaft **70** to a desired output rotational velocity for the spray head **32**. A head pipe **76** depends from the spray head **32** into the channel **66**. The channel **66** directs the water through the sprinkler **10** and into the head pipe **76**. The head pipe **76** has external gear teeth **78** that mate with the gear teeth of the output gear **74** such that the drive mechanism **72** transmits rotational drive to the head pipe **76**. Thus, rotation of the drive mechanism **72** rotates the head pipe **76** which, in turn, rotates the spray head **32** to which the head pipe **76** is connected. The turbine **52**, drive shaft **70**, drive mechanism **72**, head pipe **76**, and spray head **32**, among other components, may be lubricated, such as with a grease, to reduce friction.

When the sprinkler **10** is emitting water, foreign particulate matter is generally prevented from entering the sprinkler **10**. That is, the force of exiting water prevents matter from entering the nozzle outlet **36**, and the filter or screen **12** prevents matter from entering into the sprinkler **10** through the inlet **22** or water source. However, when the sprinkler **10** is shut off, foreign matter may enter.

More specifically, when the sprinkler **10** is shut off, the movable housing **30** is biased by a spring **77** to retract into the sprinkler case **20**. In the event the sprinkler **10** operates as intended, the movable housing **30** retracts so that the nozzle outlet **36** recedes into the sprinkler case **20** at a position close to or flush with the ground, yet the nozzle outlet **36** is not protected from the elements until it is located within the sprinkler case **20**. Further, the movable housing **30** may occasionally not operate as intended, leaving the nozzle outlet **36** exposed to the elements. In either event, it has been found that with prior sprinklers, when they are shut off, water will drift downward through the main water channel and through the turbine, which has been found to enable entry of foreign matter, such as through a vacuum being created. As a result, the foreign matter carried by the water may infiltrate into the internal components, such as the drive shaft turbine and gearing of the drive mechanism, and cause them to malfunction or become damaged. Moreover, the foreign matter will become stuck in any lubricant, such as grease, and cause excessive wear.

In order to reduce the potential for foreign matter to enter the sprinkler **10** through the nozzle outlet **36**, a protective member **80** is disposed to operate in the channel **66** of the movable housing **30** between the main water channel **66** and the lower cavity **60**. The protective member **80** may be a screen (not shown) or other structure that permits the passage of fluid, while generally restricting or preventing the passage of particulate contaminants. Preferably, the protective member **80** is in the form of a movable barrier. The barrier **80** has a generally closed or obstructing position (FIG. **3**) that generally prevents the backflow of water and foreign matter toward the water source, and has an open position (FIG. **4**) in which the barrier **80** is moved generally out of the stream of water as it passes through the sprinkler **10** from the lower cavity **60** to the main water channel **66**. The force of the passing water causes the barrier **80** to move from the closed position to the open position, as depicted in FIG. **4**.

In the preferred embodiment, the movable barrier **80** is positioned to operated between the drive housing **62** and the interior surface **64** of the movable housing **30** adjacent the lower cavity **60**. When the water is shut off, the movable barrier **80** shifts from the generally open position to the generally closed position, in which it extends between the drive housing **62** and the interior surface **64** to obstruct flow from the main water channel **66** to the lower cavity **60**. This movement can be effected in a number of ways, such as with a bias mechanism, resilient material, the weight of the barrier **80**, or a combination thereof. Although there may be a slight delay from when the water is shut off and the movable barrier **80** reaching the closed position, foreign matter entering the nozzle outlet **36** when the water is shut off in the preferred embodiment will not reach the barrier **80** before the barrier **80** is able to move to the closed position because of the distance from the nozzle **346** to the barrier **80**.

With reference to FIG. **5**, the preferred barrier **80** has a flap-like construction **82** with a first edge **83** and a free edge **85**. The first edge **83** is anchored to the drive housing **62**. The flap **82** extends from the channel side **69** to the interior surface **64** of the movable housing **30**. With reference to FIGS. **3-5**, the preferred flap **82** is a unitary structure formed of a resiliently deformable material. The first edge **83** may be clamped between the bottom plate **63** and the drive housing **62**, as can be seen in FIG. **3**. The force of water applied to a bottom side **84** of the flap **82** will cause the flap **82** to be folded upward into the channel **66** so that water may pass by the flap **82** and into the channel **66**. When the water is shut off, the natural resilience of the flap **82** will cause the flap **82** to return to the

generally closed position. In the generally closed position, the free edge **85** rests against the interior surface **64** of the movable housing **30** such that water backflow, as well as any particulate matter therein, is generally restricted from passing into the lower cavity **60**. The flap may have any other structure, such as a hinge (not shown), or a bias element (not shown), such as a spring, that enables the flap **82** to act as a one-way valve type obstruction for particulate matter in the water flow.

The channel **66** preferably includes an internal shoulder **86** on which the free edge **85** of the flap **82** rests when the flap **82** is in the generally closed position. The shoulder **86** ensures that the flap **82** does not deform or move downward, which otherwise may allow foreign particulate matter to pass by. Alternatively or in addition, the flap **82** may be over-sized. The flap **82**, when laid flat, traverses across the channel **66** and may have an area greater than the transverse cross-section of the channel **66**. In this form, the over-sizing of the flap **82** helps prevent foreign particulate matter from passing by the flap **82**. When the flap **82** moves to the generally closed position, it can bunch against the interior surface **64** and/or the shoulder **86** of the movable housing **30**. In any case, the flap **82** may have either a uniform thickness or a varying thickness. For example, the over-sized form of the flap **82** benefits from thinning towards the free end **85** because the described bunching is promoted by a more compliant structure.

With the embodiments described above, when the flap **82** is in the substantially closed position, foreign particulate matter that may enter the sprinkler **10** from the exterior is restricted or obstructed from entering the lower cavity **60**, and thus encountering the turbine **52**, the drive shaft **70**, the drive mechanism **72**, and other moving parts of the sprinkler **10**. Any such matter or debris that enters the sprinkler **10** falls onto a top surface **88** of the flap **82**. When the sprinkler **10** is activated and water forces the flap **82** to move to the substantially open position, the foreign contaminants or matter resting on the top surface **88** are generally flushed out of the sprinkler **10** by the water flow through the channel **66** and out of the nozzle **30**.

While the invention has been described with respect to specific examples, including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques that fall within the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A sprinkler comprising:

an inlet and an outlet for fluid communication with a pressurized water source;

a body interconnecting the inlet and the outlet, and the body defining at least in part a main fluid channel in fluid communication with the inlet and the outlet;

a turbine disposed between the inlet and the outlet and being configured so that contact between the turbine and fluid flow causes rotation of the turbine;

a drive mechanism for rotating the outlet;

a drive housing being located in the body for covering a portion of the drive mechanism, the drive housing defining at least in part the main fluid channel; and

a flap positioned in the main fluid channel along at least a portion of the drive housing, the flap having an open position permitting fluid flow from the inlet to the outlet and being directly moved to the open position by the fluid flow, and a closed position wherein the flap traverses across the main channel from the drive housing to the body to restrict particulate entering the outlet from encountering the turbine when the pressurized fluid flow is shut off to the sprinkler, and the flap being naturally biased to move to the closed position when the fluid flow is shut off to the sprinkler.

2. The sprinkler of claim **1**, wherein the drive mechanism generally extends parallel to a portion of the main channel and down stream of the flap.

3. The sprinkler of claim **1** further comprising an accessway into the interior of the drive housing, a shaft extending through the accessway and having a connection to the turbine and a connection to the drive mechanism such that rotation of the turbine drives the drive mechanism for rotating the outlet, and wherein access from the passageway and to the connection between the shaft and drive mechanism is through the accessway, and a plate defining the accessway, and wherein the shaft extends through the the accessway, and wherein the flap is a flexible element having a fixed end connected to the plate and a free end disposed outwardly from the plate.

* * * * *